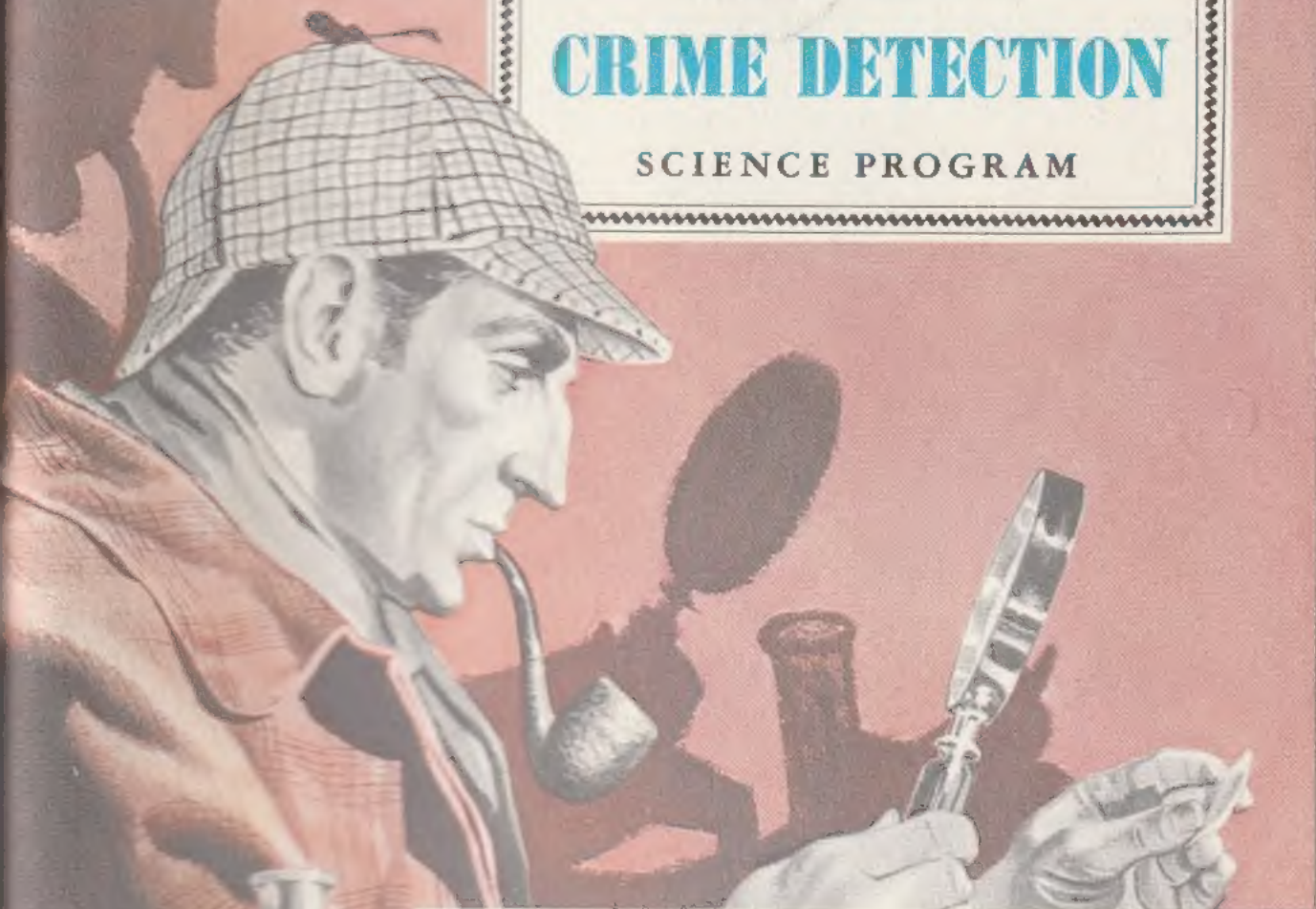


Science Service

# CRIME DETECTION

SCIENCE PROGRAM



SCIENCE  
AND  
CRIME DETECTION

*by*

DENIS BRIAN

NELSON DOUBLEDAY, INC.

•

GARDEN CITY, N. Y.

*Prepared with the cooperation of  
Science Service*

We gratefully acknowledge our appreciation for the cooperation extended by J. Edgar Hoover and the Federal Bureau of Investigation in the preparation of those portions of this booklet which concern the FBI.

© COPYRIGHT 1960

By NELSON DOUBLEDAY, INC.

PRINTED IN THE UNITED STATES OF AMERICA



## SCIENCE AND CRIME DETECTION

**F**OR THOUSANDS OF YEARS, some criminals have gotten away with their crimes while innocent people were punished. Why? Because there were no sure ways of telling men apart or linking the criminal to the crime. If witnesses thought a man was the one seen killing or stealing, then just because he looked something like the real criminal, that man was accused, arrested, and even tortured. Often a prisoner under torture would confess to a crime he had not committed.



1. ROYAL CANADIAN MOUNTED POLICE

Troopers of the Royal Canadian Mounted Police ride out from their headquarters. Their uniform may be glamorous, but their job is as arduous as that of any other police officer anywhere in the world.

Over three thousand years ago a Pharaoh's tomb in Egypt was robbed of its treasures. One of those accused confessed when "examined" under the lash. To make sure he was telling the truth, the judge had him led to the tombs and ordered him to show which one he had robbed. He indicated one of the tombs of the king's children from which nothing had been stolen. Was he guilty? No one will ever know.

Men suspected of crimes have had their feet and hands crushed between stone rollers until they said they were guilty. These and other tortures, such as the rack and thumbscrew or the "water cure" (in which liquids were forcibly poured into the mouth), could make most men confess to anything.

Women accused of witchcraft were thrown into deep water. If they sank, they were judged innocent. If they floated, they were considered guilty and burned to death. Those who sank usually were left to drown, so that innocent and guilty alike perished in these cruel tests. In a village where some cattle had died, a stranger would be hauled before the court by a pack of superstitious villagers and made to undergo trial by ordeal. He would have to plunge his arm into boiling lead or water. If his arm healed quickly, he was considered innocent.

Even today torture is used to extract confessions. The horrors of the Inquisition have been surpassed by the methods of the Gestapo and investigators in other police states.

Asia was one of the first places where men tried to obtain the truth about crime without using torture. Suspects were each given dry rice to eat. Those who could not swallow all their rice, or who failed to spit it out when requested, were pronounced guilty. This had some sense in it since emotions affect the working of the salivary glands. A frightened person, one perhaps trying to hide a guilty secret, has difficulty swallowing and spitting.

A test of this kind was not truly scientific, yet was more likely to yield the truth than the thumbscrew. Its weakness? For one thing, no allowance was made for inability to swallow because of a sore throat.

"Magic" was another method used. Suspects were told that they would be exposed to a "magic" donkey. One by one they would be sent into a darkened room to pull the animal's tail. "If you are guilty," the magistrate would tell them, "the donkey will bray when you pull its tail." Secretly the magistrate would have covered the donkey's tail with soot. After the test the hands were examined. Those without soot were considered to have been afraid to pull the tail and so were judged guilty. The drawback of this system was that as soon as the method was known, both innocent and guilty men would pull the tail.



STRETCHED ON THE RACK



## *The Sword of Solomon*

ONE JUDGE of the old days, about three thousand years ago, is still known for his wise decisions. He was Solomon, king of Israel. When two women claimed a child to be theirs but brought no evidence or witnesses, Solomon called for a sword. Then he ordered the child to be divided in two, so that each mother would get an equal half. Immediately one of them cried out, "O my lord, give her the living child, and by no means slay it." Solomon judged the woman who cried out to be the real mother of the child and he awarded it to her. He assumed that rather than let her child be killed she would give it away to another.

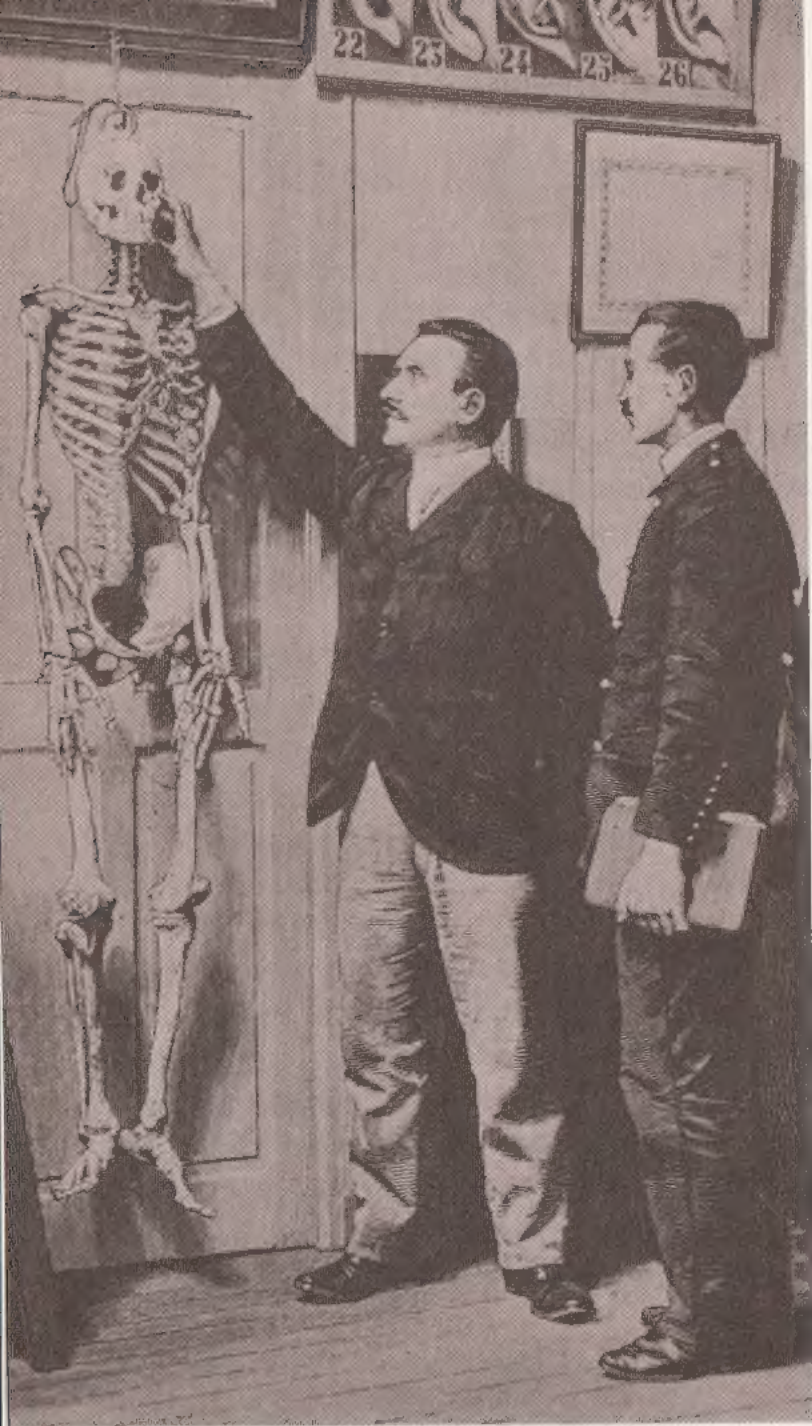
Today, footprints are taken of babies soon after they are born, and this is a certain way of making sure that a baby born in hospital is given to the right mother when a question of identity is raised. Blood tests are frequently made to establish the identity of the father of a child. Though these do not indicate for certain that he is the father, they may indicate if he is not.

An improvement in trials took place when crimes were considered to be an act against the government instead of against another person. It was then that a prosecutor came into existence, a man whose job was to find evidence of the criminal, charge him, and expound it at the trial. His opposite number was the defense advocate whose job was to find evidence defending the innocence of the accused. Both of them use detectives to help them in this task. Scientific evidence in the early days was rejected by courts because of errors and false claims, and experts were consulted only when it was absolutely necessary. Even today the evidence of a psychiatrist, for example, is regarded by many a jury with suspicion, especially when psychiatrists cannot agree among themselves.

Science really started to develop when scientists learned to take an objective attitude toward experiments, accepting only those as proved which could be repeated by other scientists of equal knowledge and skill. Most of the progress in applying science to the investigation of crime is surprisingly recent, developing as science itself developed during the past one hundred and fifty years.

## *Bone Measurements*

A GREAT STRIDE in the identification of criminals was the discovery that measurements of the bones could distinguish individuals. A bright young clerk in the Paris police department, Alphonse Bertillon, saw how



In this old print, an instructor of the French Police points out the Bertillon system of identifying criminals by comparing body measurements. Notice the different types of ear in the painting.

this could be used in the fight against criminals. No longer would they be able to hide behind false names and false whiskers. He began to record their bone measurements, which he filed with full face and profile photographs. The scheme worked wonderfully and spread everywhere. For the first time previously convicted criminals faced identification with their previous records.

The Bertillon system was welcomed throughout the United States. In the past "wanted men" had been sketchily described as follows:

## **\$150 REWARD BROKE JAIL!**

**WILLIAM RAVENSCRAFT**, American, light hair, about 5 feet 10 inches high, genteel dress, thin in flesh, has a crease in his under lip, about 28 years of age.

\$50 will be paid for this man delivered to the Chicago Jail.

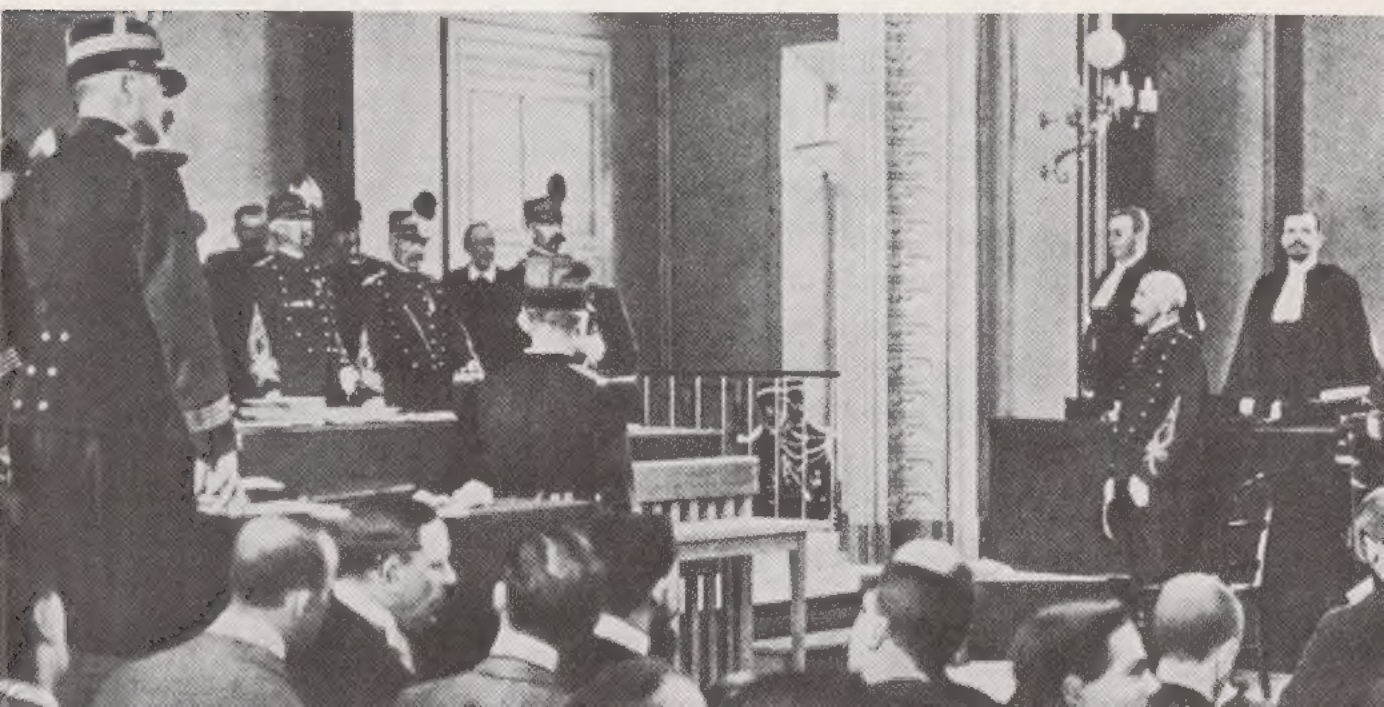
\$25 for any private information of the above described.

I. Cook, Sheriff, Cook County, Chicago.

August 4th, 1847.

Under Bertillon's system, photographs of criminals together with detailed bone measurements made their identification much more likely. The lesson of this early use of science is incomplete without an account of the scandalous Dreyfus case and the false identification of handwriting into which Bertillon was suborned by political pressure and for which he utilized his reputation as an expert in criminology.

Taken more than 60 years ago, this photograph shows Capt. Dreyfus standing bareheaded before the Council of War during his trial.



Alfred Dreyfus, a French army captain, son of a Jewish manufacturer, was convicted of being a German spy, and in 1895 sent to Devil's Island for life. The main piece of evidence was a letter which revealed French military secrets. It had been found in the wastebasket of the German military attaché at the Paris Embassy. In order to pose as a handwriting expert, Bertillon invented a "new system" of handwriting identification and reached an "opinion" that the writing of the letter was that of Dreyfus.

Eventually, when genuine handwriting experts examined the letter, it was proven that Dreyfus was innocent and the writing was that of Major Esterhazy, a Hungarian in the French army. For Bertillon to have called himself an expert on something about which he knew very little was a scandalous blot on the otherwise fine record of his achievements.

The bone-measurement (anthropometry) system worked with great success until one day in 1903, when a strange thing happened. A prisoner, Will West, arrived at the Leavenworth Penitentiary in Kansas. Another Will West was already there, serving a life sentence for murder. Not only were their names the same but so were their bone measurements, and their faces were so alike that nobody could tell the two men apart. As a sure method of identification the Bertillon system had failed. The theory that no two men are exactly alike was not wrong, but it proved to be not their bone measurements alone which showed the difference. It was their fingerprints.

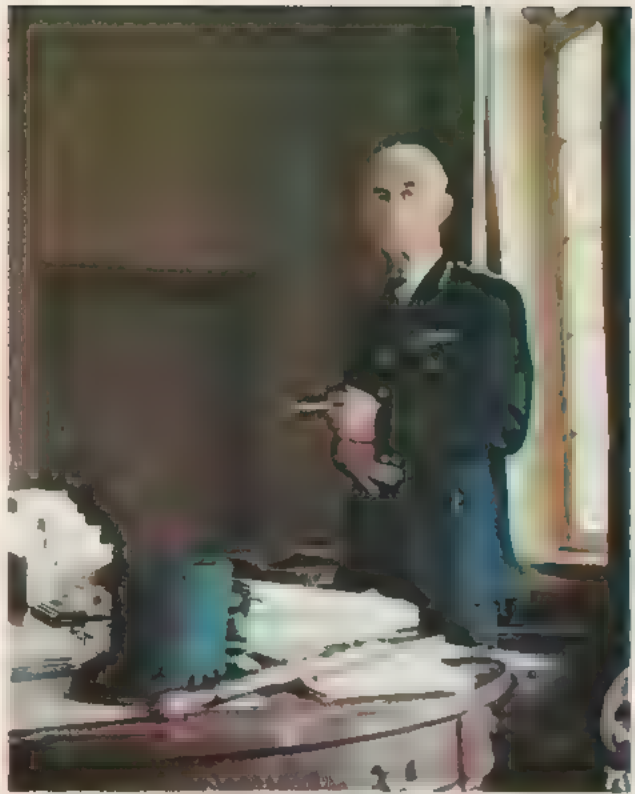
## *Fingerprints*

**I**T WAS the English scientist Sir Francis Galton who, after experimental research, concluded that fingerprints are a certain means of identification. Single prints had been used as signatures for identification purposes for many years in China and other Asian countries where few of the population were able to write. Another Englishman, Sir Edward Henry, Inspector General of Police in Bengal, developed a method of classifying fingerprints. It described the combination of all ten fingerprint patterns in terms of a numerical formula. Such a formula, of course, can be transmitted by wire or radio all over the world in a few seconds.

Scotland Yard adopted the Henry System in 1902, and United States record bureaus followed suit in 1903 and 1904.

Science had well and truly entered the fight against crime. Now the criminals tried to outwit science. They had their fingerprints removed by surgery. But they could have spared themselves the trouble. Science was usually one step ahead of them, identifying injured fingertips even more easily than whole ones.

Sir John Nott-Bower was, until he retired in 1958, England's number-one policeman. His title was Commissioner of the Metropolitan Police. He is seen here in his office at Scotland Yard.



2.

SIR JOHN NOTT-BOWER

Scientists found ways of tracing criminals by blood, by hair, even by invisible specks of dust. How could a criminal hope to remove evidence of his crime when it was invisible to him?

Dust collected from the clothes of a suspect by a vacuum cleaner may show that he was present at a crime scene. Dirt from the wax in a man's ears has identified him as a murderer. Edmund Locard, famous French Police Laboratory scientist, said he could tell the particular work of 92 out of 100 manual laborers by examining the dust in their ears.

In their laboratories today scientists quickly test blood to see if it is human or animal, examine hairs, glass, paper, wood, and mineral objects to discover where they came from. A crime is an illegal act at a place. Materials foreign to that place, which may have been left there by a criminal, link the man to the place. Also, materials naturally found at the place but consciously or unconsciously taken away by the criminal will link him to the place.

Forgers, blackmailers, and writers of poison-pen letters must face the fact that today scientists can trace the crime to them by the very paper, pen, or typewriter they used. Hit-and-run automobile drivers, no matter how fast they drive away from the scene of their crime, will have left some trace, per-

haps a tiny speck of paint from the automobile, which will link them to the crime.

A "law" that applies to both natural and man-made things traps the criminal these days. The law asserts that no two things—the leaves on a tree, the fingerprints of a man, the words typed by two different typewriters, or the bullets fired by two different guns—are exactly alike. They may seem so to the naked eye, but a scientist can detect the differences.

Many of the laboratory instruments and tests available to science are now being used in crime detection. Some were developed for quite different purposes and have been modified for this special use. The spectroscope, used for chemical analysis and to see what stars are made of, shows the presence of gas and poisons in the blood. The spectrophotometer identifies dyes in minute amounts. The fluoroscope, with which doctors observe signs of internal illnesses, can be used to photograph wrapped parcels to see if they contain bombs. Specially adapted microscopes "compare" bullets and then photographic copies are made by adapted cameras. The blood pressure instrument of the physician is combined with electric measurement of sweat secretion to form the polygraph or lie detector, which measures emotional response to questions.

In the Petrography Unit of the FBI, soil is being removed from a suspect's shoes for mineral analysis.





An examiner in the Document Section of the FBI Laboratory makes ink tests under a microscope.



The "body" of a man lies sprawled on the ground. Around him lie scattered pieces of wood, his hat, and a bucket. What should this indicate to an investigating officer? Here, a group of recruits in the Royal Canadian Mounted Police learn to detect evidence.

## FACTS AND EVIDENCE

**S**INCE the earliest days of crime detection, investigators have collected two kinds of evidence: 1) materials and scenes affected by the crime, and 2) statements by witnesses under oath.

Scientists have concentrated most on the first kind of evidence. Only in psychological tests, and with the lie detector and "truth serum," has science tried to ensure that witnesses are telling the truth. The "truth serum" could

be called a modern version of alcohol, perhaps the first drug to cause men to lose self-control and say what was in their minds. Other methods closer to torture, like depriving a suspect of sleep and keeping him in a constantly lighted cell, have been used to break down self-control and secure a confession.

The crime investigator and laboratory scientist, after thousands of years, are producing an age in which crime will not pay as well as it did in the past. The day is not far off when detection and conviction of criminals will be almost certain. Fewer and fewer will escape discovery, and perhaps more importantly, science will help protect the innocent from punishment.

## THE SCIENTIFIC DETECTIVES

ONE OF THE MOST exciting lives in the history of scientific crime detection was that of a British doctor, Sir Arthur Conan Doyle. He turned from writing prescriptions to writing books about a fictional private detective called Sherlock Holmes. But this detective, unlike all the others the world had known up to the year 1887, went about searching for clues like a scientist. He used a knowledge of chemistry, anatomy, psychology, and geology to help him. He did not overlook the slightest traces, even dust, in his attention to small details.

Not only did Sherlock Holmes become the most famous fictional detective in the world, but his creator Conan Doyle was called upon to solve actual crimes. Amazed by the methods of the detective in his stories, people asked the author for his help.

In one instance, a man had been arrested, convicted, and imprisoned for wounding horses and writing threatening letters. Doyle discovered that the man in jail was so nearsighted that he could not possibly have run across fields at night during a rain storm, as was suggested at the trial.

Doyle, who always kept a magnifying glass on his desk and a revolver in his drawer, also examined the threatening letters carefully. By noting certain phrases and words used in the letters, he was able to build up a picture of the writer: he had gone to a certain school, he was a sailor, he had worked for a butcher. Doyle's system of identifying the culprit by *what* he wrote (his choice of words) as distinct from *how* he wrote (his style of handwriting) could be followed by anyone, and he finally was able in this case to point out the real criminal and free the innocent convict.

In another case, Doyle worked for what is probably the record length of time to prove a man innocent of a murder for which he had been im-



SIR ARTHUR CONAN DOYLE

prisoned. It took him sixteen years. Doyle had all the qualities of a great scientific investigator—knowledge, energy, enthusiasm, intelligence, and persistence.

In one of his novels Doyle mentioned the use of plaster of paris to preserve footprints. Several years later, in 1891, Hans Gross, professor of criminology at Prague University, wrote a book called *Criminal Investigation*. This book is a standard text of modern crime detection. In it Gross agreed with Doyle that plaster of paris was the best substance to preserve footprints. It is still used today, in addition to plastics and other molding compounds.

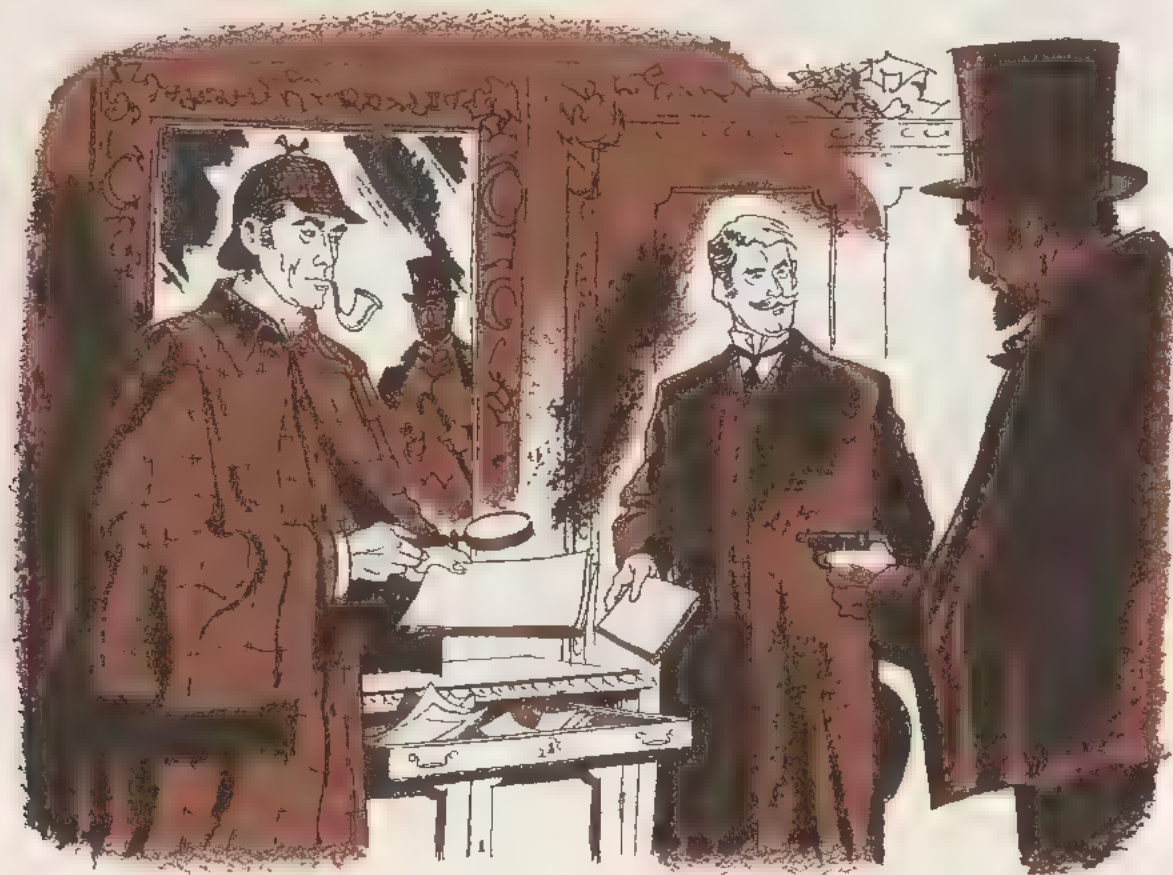
Conan Doyle inspired many men who were to become detectives and use his methods. Dr. Edmond Locard, chief of the police laboratory at Lyons, France, said that his special interest in dust as a clue in criminal cases was due to having absorbed the ideas found in Doyle's detective novels. Locard advised all police specialists and magistrates to read these books.



A suspect is booked by the desk sergeant, who is seen here making a list of the man's belongings before locking him in a cell.

Conan Doyle also devoted his time to freeing innocent men from false imprisonment. Today in the United States, another writer of detective stories, Erle Stanley Gardner, is doing the same thing. But he has the advantage of a team of detectives, doctors, lawyers, and crime laboratory technicians, who freely give their services. His organization is known as "The Court of Last Resort." Since 1949 this group of men has removed suspicion of guilt from several prisoners, even some under sentence of death, and secured their freedom.

Today scientific crime detectives form two groups. One is composed of field investigators, men who begin with the scene of a crime. They take photographs and make drawings to show dimensions, damage, directions, and conditions at the time; they must also interview witnesses, and collect and label material evidence. The other group are laboratory analysts. They analyze materials collected for them by the field investigators. They are usually experts, devoting their time to examination of one special object, such as firearms or documents. There is also a small group, usually private investigators, who are experts in one branch of crime detection, such as questioned documents. These men and sometimes women combine the work of field investigation and laboratory analysis.





JOHN EDGAR HOOVER

### *Federal Bureau of Investigation*

**FBI** men are outstanding examples of modern, college-trained crime detectives. Those working in the laboratory have at least one science degree. Some of them have a master's or doctor's degree in chemistry, physics, electrical engineering, or biology. All of them are given thorough and special training and are highly intelligent. They have perfect vision and hearing. A man who is not "quick on the draw," able to shoot with both hands and to manage tear-gas shells and submachine guns, is rejected by the FBI. As well as knowing how to apply the latest scientific methods of crime detection, they are trained in defensive tactics.



3

FIRING A TOMMY GUN

Every special agent of the FBI must be able to shoot fast and accurately with a large number of weapons. Here, in the firing range of the FBI building, a special agent fires a burst from a Thompson submachine gun. Note the flash of flame from the muzzle and three empty shell cases.

When the FBI laboratory was opened in 1932, it had ultraviolet light equipment, and a helixometer for examining the inside of gun barrels, a borrowed microscope, and little else. Today, the FBI laboratory is undoubtedly the best equipped in the world, containing every conceivable scientific device to help in solving a crime. In its files are 155 million fingerprints, 2500 shoe patterns, 1750 designs of both United States and foreign automobile tire patterns, and more than 42,000 different watermarks in paper. If a criminal committed a crime in a zoo and had the hair of a wallaby or wombat on him, the FBI would have no difficulty identifying either. They are both in their files for comparison purposes.

## CATCHING UP WITH THE CRIMINAL

**A**CCURACY AND SPEED are essential in solving crimes and arresting criminals. When an investigator arrives at a crime scene, his first order is that nothing must be altered, removed, or even touched until it has been described and photographed in the exact position in which it was found. Some object moved an inch or two, a speck of dust brushed away, could cause a complete misinterpretation of what actually took place. Footprints, bloodstains, and other significant stains or marks are protected by little boxes or planks resting on stones—or inside a room by books. The investigator's sketch, photograph, and description of the crime scene will later be produced in court as a three-dimensional model. Next he must make a com-



#### THE FEDERAL BUREAU OF INVESTIGATION

plete search of the area, perhaps for the murder weapon, or for stolen property, or some material which could link the criminal to the crime.

The criminal's ingenuity in finding places to hide things is only matched by the investigator's ability to discover them. Valuable evidence has been found hidden in a bird cage, the space between the back of a picture and the protecting board, an old key hole, a pot in which soup was boiling over a fire, a prayer book, old boots, a dog kennel, a cuckoo clock, and of course, on the criminal himself.

An ordinary burglar alarm usually alarms the burglar, too, and gives him a chance to escape. Now stores and banks are being equipped with ultrasonic alarms. An intruder will move about, unaware that his presence has been detected and an alarm given, until the police arrive. What gives him away is the fact that he walked through a beam which he can neither see nor hear, a sound beam of such a high frequency that to humans it is a "silent sound." The beam is so sensitive that even if a wisp of smoke drifts across it, the break is recorded on an ultrasonic receiver. In a few seconds the signal is flashed to police in patrol cars and enables them to catch an intruder or prevent a fire.

## *Unseen Watchers*

**C**RIMINALS who hope to hide under cover of darkness are in for a shock. Scientists have devised a combination telescope and infrared spotlight by which an investigator can see even on the darkest night. It's a modern version of the "sniperscope" used during the Korean War. Through this instrument someone can be seen moving up to 500 feet away and identified at 100 feet. And if the someone is a criminal, he can be seen and photographed committing his crime, without giving him the least idea he is being watched. The infrared light of the spotlight is invisible to the naked eye.

Money or property can be treated with invisible chemicals. If it is stolen, then suspects have their hands examined under ultraviolet light. Should they have handled the money or property, then their hands will give them away, not by trembling but by glowing. Money has also been treated with a fluid containing radioactive isotopes. Within range of a geiger counter, the isotopes on the money cause it to click, just as it would in the presence of any radioactive material.

An FBI agent films the meeting of a spy ring.



These still shots were taken by the cameraman on the left. They provided further evidence on which both men were convicted on charges of spying against the United States. Facing the hidden camera is Herman Lang, a member of the Duquesne spy ring, in the office of Harry Sawyer.



In the event that bank robbers should be able to pass both these tests, there is a third in store for them—starring in a film. Hidden movie cameras are placed in many banks today, and more than one robber has found to his dismay that he has been “caught in the act” by the camera. Even though a bank robber may be masked or heavily disguised, the camera records his height, gestures, and the places where he may have left his fingerprints. As a result, identification and a swift capture is often assured.

### *Telegraph and Radio*

**Y**EARS AGO it was easy for a man to travel ahead of the news that he was a wanted criminal. If a crook fled on horseback, word of his crime could travel no faster than another man riding a horse. But with the invention of the electric telegraph this easy escape became far more difficult. Later still, with the growing use of radio, spectacular captures were made of criminals fleeing from justice.



Radio's first such capture occurred in 1910. The notorious English murderer Dr. H. H. Crippen had disappeared from London with his typist. Crippen was wanted for the murder of his wife. In mid-Atlantic, the captain of the liner *Montrose* happened to look through a porthole and saw a father squeeze the hand of his son. The boy looked like a girl and the father looked like Crippen. Ironically enough, Crippen and his girl friend were standing with the captain in the radio room later wondering at the marvel of radio—unaware the dots and dashes they heard were informing the world that they were on board.

Chief Inspector Dew of Scotland Yard sailed on the *Laurentic* which was due to arrive in Canada before the *Montrose*. Outside Quebec the detective came aboard the *Montrose* from a pilot boat. Watching from the ship's rail was the disguised Crippen and his "son." Chief Inspector Dew walked over and tapped him on the shoulder, saying, "Good morning, Dr. Crippen. I am Chief Inspector Dew, of Scotland Yard." Scientific history had been made in bringing a criminal to justice.

Investigators are wary of descriptions of criminals given by witnesses. As a rule a seasoned criminal will disguise himself in some way before committing a crime, and afterward get rid of the disguise. A banker once gave a description of a forger and in every detail the description was false. The beard, spectacles, hair, clothes, voice, stoutness, and height of the man had all been assumed. The criminal, who was in fact tall, had worn a long great coat and walked the short distance from the door to the bank counter with his knees bent. Consequently the banker had described him as a short man!

No criminal can hope to outpace the latest method of communication. It is called the telephotograph and moves at the speed of light, 186,000 miles a second. Fingerprints, bullets, or pictures of a suspect are photographed and the electrical impulses of the picture are relayed over long-distance telephone wires to any destination, where photoelectric cells convert the sound back to pictures.

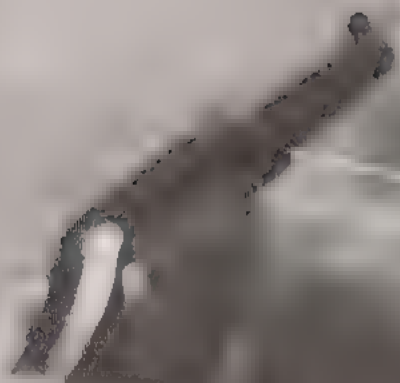
And FBI agents sitting in their radio-equipped automobiles, listening in to their field office headquarters on a preset wave length, have only to flip a switch to be in immediate contact with other agents carrying portable radios.

Since 1923 (with a break during World War II), there has been an International Criminal Police Commission. Popularly known as Interpol, it has helped to develop speedier methods of international communication on criminal matters and provides for exchange of views on the latest methods of crime investigation. Interpol has done great work in reducing the traffic in drugs and detecting false passports.

## BULLETS

ONE CRIMINAL must have thought he had committed the perfect crime. The scene was the log cabin of an old fur trader. There was no other person within miles. Outside it was snowing. The criminal killed the old man with his first shot, and then robbed him. He was very careful to leave no fingerprints. As he walked away, he noticed with satisfaction that snow was covering his footprints.

When the crime was discovered, a United States marshal immediately called on a suspect. He was an ex-convict, and had been heard to threaten the old fur trader. Now things looked very grim for him. The man had stains like blood on his socks. He stammered out an explanation that he had just shot a reindeer and in dragging it home blood must have splashed on him.



A technician fires a bullet into the recovery box in the Firearms Identification Unit of the FBI Laboratory.



One bullet was removed from the victim, the other was test fired, and both are mounted under the comparison microscope. Here an FBI Laboratory examiner prepares to photograph the two bullets.

In the FBI Laboratory, bullets are photographed under the comparison microscope to show how both are identically marked.



4. PHOTOGRAPHING TWO BULLETS

"Where's the reindeer?" asked the marshal.

"Outside," said the suspect. "I'll show you."

But there was no sign of the reindeer anywhere.

This man's rifle, bloodstained socks, and the bullet which had killed the old man were sent to the FBI laboratory. Tests proved that the ex-convict had been telling the truth.

Then a man in the area was reported to be spending more money than usual. The marshal questioned him. He swore he was innocent of the crime and willingly handed over his rifle.

A test bullet was fired from this rifle into a box of cotton waste. The bullet was then viewed through a comparison microscope beside the bullet which had killed the old man. The grooves made by the rifle on both bullets were exactly alike. The FBI laboratory reported that this rifle had definitely fired the fatal bullet.

Faced with this scientific evidence, the second suspect confessed to the murder. Though he had not been seen, had left no fingerprints, footprints, or other traces, the moment he fired his rifle he had planted all the evidence scientists needed to identify him as the killer.



Every gun in the world leaves individual scratches on the bullets it fires, which are then identified as easily as fingerprints.

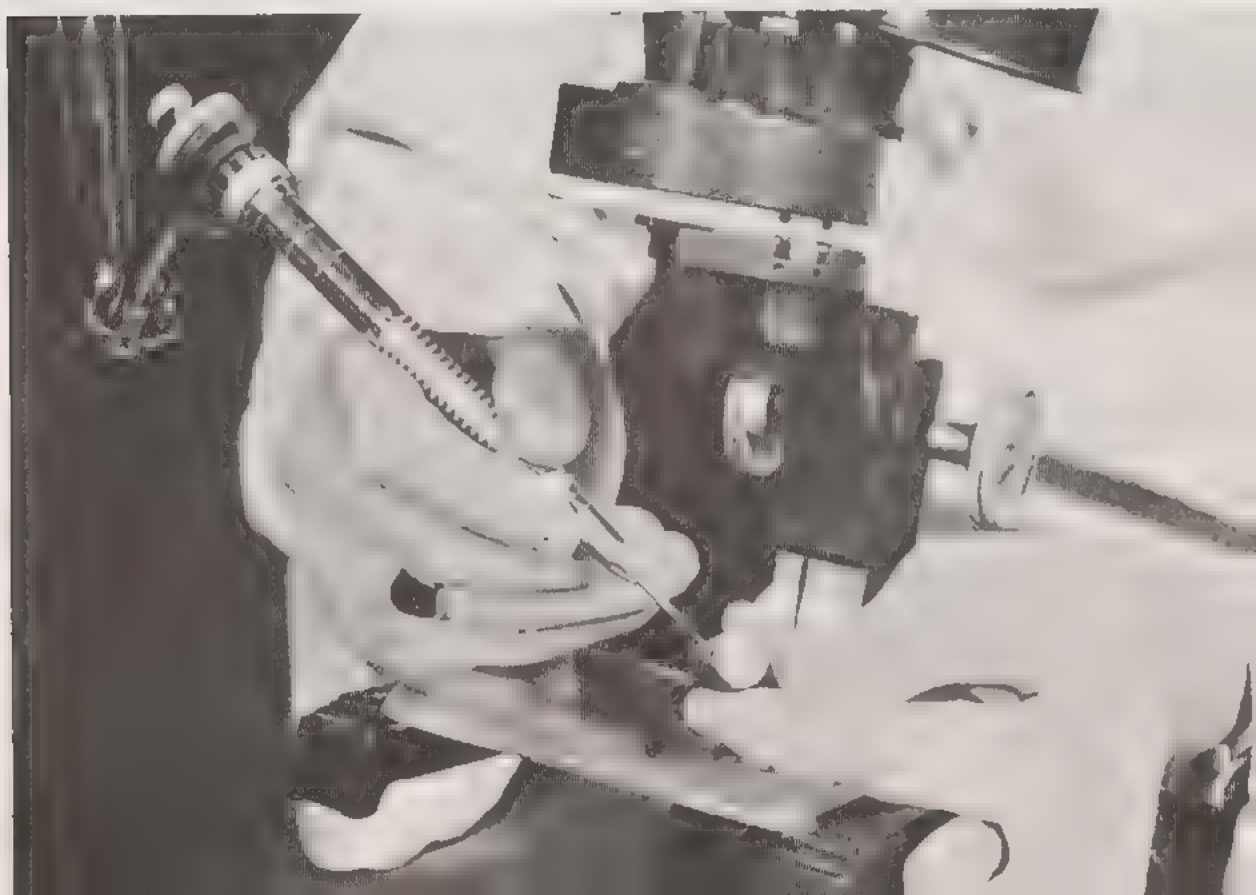
Experts could say for sure if a certain gun fired a certain bullet, but could they point to the man who had pulled the trigger? This problem was posed for them when a man was found dead with a gun in his hand. The only fingerprints on the gun were his own. Had he then killed himself? Or had a murderer, wearing gloves, pressed the gun into the dead man's hand after the killing to make it appear to be suicide?

The Scientific Crime Detection Laboratory in Chicago tackled this problem. First they poured melted paraffin and hot wax over the dead man's hand. When it had dried, they removed the mold. A chemical mixture of diphenylamine, sulphuric acid, and distilled water was then applied to the mold. Dark blue specks soon began to show up on the mold, proving the presence of nitrate particles, which had been blown into the skin by the firing of the gun.

This was an indication that the dead man had fired the gun himself.

A medical instrument, the cystoscope, used by doctors to look inside their patients' bodies, was adapted by crime fighters to look inside gun barrels. It is called a helixometer. Light from a small electric bulb illumi-

*Left: A dramatic view of a comparison microscope, used for bullet comparison. Below: A shell case is engraved with an identifying number.*





A small portion of the FBI reference collection of pistols.

nates the inside of the barrel, and a series of prism and magnifying lenses show the type of rifling and any powder or rust traces.

Scientists could prove a suspect's gun had fired a fatal bullet. They could prove his gun had been at the crime scene. Could they prove he was there, too? What was to prevent a suspect from saying that his gun had been borrowed or stolen? The answer was that his fingerprints on the gun or at the scene of the crime would prove he had been there. In the heat of the moment even the coolest criminal may forget to wear gloves.



### *Fingerprints — Your Trademark*

**R**OSCOE PITTS hoped to guard against the danger of fingerprint identification for all time by having his prints surgically removed. Then new flesh was grafted on to his fingertips from his body. For two weeks his arms were taped across his chest while he waited painfully for the grafting to take.

But when the FBI next arrested Pitts, they were able to identify him by ridges at the base of the mutilated areas.

Another criminal, John Dillinger, had his face lifted, dimples filled in, nose altered, and his fingerprints altered. After examining his old prints and his new scarred fingerprints, experts could still find enough similar points, many more than the number required as proof in court.

These criminals were not baffling science; instead, by these long, painful surgical operations, they were really making their own identification easier. For the scars on all their fingertips immediately brought them under sus-



5 FINGERPRINTS ON A SAUCER

Latent fingerprints are almost invisible. Dusting powder makes them show up so that they can be photographed. Here a pistol and a saucer have been dusted with black powder. Only those prints on the white saucer stand out at all clearly.



6 FINGERPRINTS ON A PISTOL

Here the saucer and the pistol have both been dusted with white powder. Only those prints on the pistol stand out clearly. In the background are some of the other colors used to make the prints stand out in sharp contrast.

picion, and the scars themselves were a good means of identifying them, nature making no two things exactly alike. In many instances scarred fingerprints found at a crime scene would narrow the search to a handful of possible suspects instead of many thousands. The doctors who performed the fingerprint-removing operations went to prison too.

Perspiration comes out of the pores in the fingers, and it is this which usually causes a print of the fingers to be left on anything they touch. Often such prints are invisible to the naked eye. They are called latent fingerprints. At one time the only method of making them visible was to dust them with powder. In searching for fingerprints in a kidnapping case the police covered almost every square inch of a room with dust hoping to reveal a latent print. They found none. But a New York doctor was called

in to try his new method, using iodine gas. He found 500 fingerprints!

Silver nitrate also brings latent prints to light. It changes the salt in the finger perspiration to silver chloride. This is then exposed to light and the silver chloride turns black just as it does in a photographic negative. If the latent print is on a dark background, calcium sulphide is used and a light print is produced.

### *Arches, Loops, and Whorls*

**F**INGERPRINTS are classified into eight types: 1) plain arch, 2) tented arch, 3) radial loop, 4) ulnar loop, 5) whorl, 6) central pocket loop, 7) double loop, 8) accidental (a combination of two or more types).

Fingerprints offer the only known means of positive identification. No two fingerprints have been found that are exactly alike. For purposes of classification and filing they are divided into three general groups, Arches, Loops, and Whorls, which are then subdivided into

eight pattern types. They are shown here as they would appear on a right hand. The FBI's Identification Division has over one hundred fifty-five million sets of fingerprints in its files. This number is increasing every day.



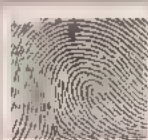
Plain Arch



Tented Arch



Radial Loop



Ulnar Loop



Plain Whorl



Central Pocket Loop



Double Loop



Accidental

# Science Bulletin

Prepared by SCIENCE SERVICE

## PSYCHIATRY

Most murderers are sane. They are not mentally ill, but they do have an abnormal or infantile disregard for human life. So concludes court psychiatrist Manfred S. Guttmacher in a recent book, THE MIND OF THE MURDERER (Farrar, Straus and Cudahy). Of 175 murderers studied by Dr. Guttmacher, 105 definitely were not psychotic and had no mental disease or derangement; 53 were mentally ill; and 17 were seriously abnormal.

Nearly every insane murderer exhibits some sign of insanity before he kills. His crimes are not well planned and may take place in full view of onlookers. Any handy object is used as a weapon and the crime is generally extremely bloody. Victims of the insane killer are usually intimate associates, frequently his own children. There is seldom any remorse and motives revealed in freely given confessions seem completely inadequate to a sane person.

One-fifth of Dr. Guttmacher's mentally ill murderers had records of previous assault or serious criminal offense and more than one-third had little or no memory of the crime. Among the nonpsychotics, two-fifths had such records, and failure to remember the

crime was rare unless the perpetrator was dead drunk at the time.

In addition to the "normal" murderer, these other types were listed:

Sociopathic: This type of individual wages a war against society and has been called "a rebel without a cause."

Alcoholic: Murders have been committed by persons with acute alcoholic delirium while defending themselves against creatures of their own diseased imaginations. But more often, alcohol unleashes suppressed and repressed aggressions.

Avenging: The victim may be a deserting wife, husband or sweetheart, but sometimes the attack upon the hated-and-loved person is indirect, by destruction of something or someone held dear by that person.

Schizophrenic: Most psychotic murderers are schizophrenics, characterized by hostility which often reaches murderous proportions.

Temporarily psychotic: The murderer who is insane at the time of the crime but sane before and after has a history of lack or loss of control of aggressive impulses. Many have reported their fear of losing control to police or to psychiatrists before the murder took place.

## COMPUTER

An electronic brain at the California Institute of Technology is figuring out which human brain processes result in creative thought. Basic research on man's nervous system is fed into an electronic computer that is programmed to represent mathematically the human mind. By the rapid simulation of brain functions on

the machine, a nearly infinite number of hypotheses about human thinking can be tested.

## SURGERY

A new surgical technique for closing and lengthening a cleft palate in a single, one-hour operation has been perfected by Drs. Richard B. Stark and Clayton R. DeHaan of St. Luke's Hospital in New York. Their method is to lengthen the palate by transferring to it a flap of mucous membrane and muscle from the pharynx. The flap keeps air from leaking into nasal passages and prevents the resulting indistinct or "fuzzy" speech, which often follows conventional operations that close the palate but do not lengthen it.

Previously, palate lengthening has been a separate operation, performed only when the closing operation resulted in fuzzy speech. Parents were then faced with re-training the child to speak. Surgical correction, carried out before the child ever learns to talk, could eliminate this problem and might also prevent the hearing difficulties that often accompany cleft palate, Drs. Stark and DeHaan report.

## RADIO ASTRONOMY

Radio energy from a radiation belt 255,000 miles above the surface of planet Jupiter is one hundred trillion times that expected from the earth's belt, California Institute of Technology scientists have found. Jupiter's radiation, at a frequency of 960 megacycles, is, more specifically, synchrotron radiation. It is caused by high-speed electrons that are trapped in the planet's magnetic field and emit radio

waves as they spin back and forth along the line of magnetic force.

## APIOLOGY

The warbling of bees in a hive can now be used to predict when the colony will swarm some 15 to 25 days before actual swarming. Normal bee sounds range from 100 to 600 cycles per second, within the range of human hearing. But in the days before swarming time, warbling changes to a pitch of 225 to 285 cycles per second and the volume drops 10 decibels from normal daytime intensity, E. F. Woods of Surrey, England, has found. These changes can be detected by an electronic device called the "Apidictor," which Mr. Woods has patented. One of the non-stingproof methods now used to predict imminent swarming is examination of each hive every 10 days from mid-April to mid-July for signs of queen cells.

## IN SHORT

The compulsive gambler cannot quit when he is ahead but must keep on playing until he loses.

Houseflies resist man's insecticides by means of an adaptable enzyme system that changes from one generation to another.

The best frequencies to use for communications between earth and space vehicles are between 70 and 6,000 megacycles.

Doctors have found cases in which a single razor cut resulted in skin cancer within a month.



The prints of a suspect are quickly checked against those on file.

Everybody in the world has at least one and possibly all of these types on his finger and thumb tips. One person will have all tented arches, another will have all radial loops, a third will have five tented arches and five radial loops. Such variations are recorded from the fingertips of criminals, and filed under 1024 primary groups for quick reference.

A fingerprint can sometimes give away the age of its owner. An expert counts the number of lines in a set distance. Fifteen to eighteen lines in a distance of five millimeters (about one-fifth of an inch) means the print is that of a newborn baby; thirteen lines are found on children of eight to ten years old; twelve lines are found on twelve to fourteen years old; nine to ten lines means the owner is over fourteen. Six to seven lines in a distance of five millimeters stamps the print as belonging to an adult with extremely big hands.

Fingerprints not only defy complete removal from fingertips even with surgery, but fingerprint traces survive some very rough treatment. Fire up to a heat of 500 degrees C. does not destroy them; in fact, it often attaches them even more securely to material. One burglar broke in through a window and fearing his prints were on the glass he dropped the broken pieces into a barrel of water. These pieces were recovered and dried. Latent fingerprints were developed from them which sent the burglar to prison. Fingerprints have survived heavy rain and ice water.

At one time fingerprints could only be seen on shiny surfaces. The disadvantage of this was that frequently the criminal would notice them himself and wipe them off. Today latent prints on wood and paper, though invisible to the naked eye, are made to appear with chemical treatment, and a good clear photograph of them can be taken.



The FBI gets its man. John Dillinger was shot while drawing his gun as he came out of a movie theatre.



The heel of a suspect's shoe is compared by an FBI examiner with that of a cast made at the scene of a crime.

Science has also thought of the innocent member of society who is fingerprinted at the scene of a crime—especially the lady who has just had a manicure and is on her way to a party. An “inkless” pad has been invented which does not dirty the fingertips.

### *Pore Prints*

**N**OWADAYS investigators do not need a whole fingerprint to identify anyone. A new science of detection based on the pores has been created by the brilliant Frenchman Dr. Edmond Locard, of Lyons. He has proved that no two human beings have exactly the same pore prints. He identified one criminal by producing the pattern of his pores which had been left on a piece of candle wax the size of a grape pip! Locard has also been able to indicate the sex of a person by studying pore prints. In practically all cases women's pores are much smaller than men's.



The getaway car left tire marks in the mud. . . . A cast was made and is now compared with designs and specifications in the FBI file of tire treads.

Criminals have lost a round to science, over finger and pore prints. A cool and cautious criminal might avoid any contest with scientists by wearing gloves at all times. But gloves can be identified by their fabric, and pattern which also leaves traces. How could he avoid leaving his shoe prints at the scene of the crime, especially if the area was muddy?

Detectives made plaster cast impressions of shoe prints found near a murder victim, and sent them to a crime laboratory. Back came the report to this effect: The prints were firm and especially clear at the heel, which indicates that this person was not running but calmly walking from the scene. His shoes were size thirteen, which indicates a tall man. They were pointed at the toes, a style of shoe generally worn by men who dress flashily. Police were advised to look for a cool, collected man, over six feet tall, who dressed in flashy clothes and walked toeing out.

A suspect was arrested who fitted this description completely. Dirt from his heel and a spot of blood on his shirt were examined. He was proved to be the murderer.

Aware that their shoe prints could give them away (the FBI has prints of 2500 different types of shoes for comparison purposes), some criminals thought they had found a way of not being detected by removing their shoes and working in bare feet. Socks would be too slippery to work in. Here again they trapped themselves, for footprints have proved to be as individual as fingerprints.

## BLOOD

**T**O AVOID getting any blood on his clothing, one murderer stripped naked before killing his victim. But he was suspected of the crime and found it impossible to explain how blood from his victim was found under his toenails!

Another murderer wore an overcoat several sizes too large, which completely protected all his other clothes from blood splashes. After the murder he burned the stained overcoat. But he was caught. His victim's blood was found in the nail holes of his shoes.

So, careful, science-conscious criminals began to take extra precautions. They boiled and rinsed their bloodstained clothes, and bathed themselves. Then clean and shining, they faced detectives to protest their innocence. But, ironically, it was their attempts to wash the evidence away that trapped them. One drop of benzidine and hydrogen peroxide turns the bathtub or basin blue where there are any traces of blood.

In the Serology Unit of the FBI, blood can be identified as coming from humans or animals, and if human, classified by blood group.





A murderer may think he has wiped the murder weapon clean. But, probably, there are traces of blood still there. Chemical tests will prove definitely whether or not blood is present.

Could a criminal hope that time would wash such traces away? Hardly. It has been said that Egyptian mummies 5000 years old have turned blue in spots where benzidine and hydrogen peroxide were applied.

Frequently when bloodstains are found on a suspect or his clothes, he claims that they are from an animal. If he says they are from a rabbit, for instance, a test will reveal whether he is telling the truth. The bloodstains are soaked in salt water in a test tube. Serum, the straw-colored liquid in blood, from a rabbit that has been immunized with human blood is added. Should a white ring appear in the test tube, then the bloodstains are human.



7. PART OF THE FBI'S FILING SYSTEM

The Identification Building of the FBI occupies a city block. This portion of the filing system is electrically operated.

## *Blood Groups*

**S**UPPOSE the suspect claims that he merely made a mistake in reporting the bloodstains as from a rabbit, and insists that the blood which caused the stains was his own? His chances of getting away with a lie have been greatly reduced since 1900. In that year Dr. Karl Landsteiner of the Rockefeller Institute made the discovery that blood can be classified by group or type. The four main groups are known as A, B, AB, and O. Since then twelve basic blood groups have been found. From seven of these groups scientists can identify 23,616 different types of human blood.

Blood groups, like fingerprints, never change. Even if a criminal were to replace all his blood by a thorough transfusion of another group, three months later his blood would have changed back to its original group.

One killer tried to avoid capture by covering human blood with animal blood, but the presence of human blood was detected.

Blood can also be identified under the microscope, through which the shape and size of the red blood cells are visible. These differ in most animals. Though both men and monkeys have round blood cells, the sizes are

different. The average size in a man is  $1/3250$  of an inch. In a monkey it is  $1/3382$  of an inch. Chickens have oval red blood cells.

A murderer who had the good luck to spill the blood of a victim who was the same blood group as himself had the bad luck to live in a scientific age. By measuring the amount of light scattered by molecular lumps in blood, Dr. Wilhelm Zangmeister could distinguish the blood of twenty people who belonged to the same blood group.

## POISON

**I**N MOST CITIES these days anyone who dies suddenly or mysteriously is examined for signs of poison. A toxicologist, as a poison specialist is called, noting that the kidneys are inflamed would suspect mercury poisoning; signs of tetanus, such as rigid muscles, would indicate strychnine. Poi-

A technique for determining the presence of poisons in the organs removed from a victim's body is applied here by the FBI.





A technician in the FBI burns a minute specimen on the spectrograph, an instrument capable of analyzing inorganic substances.

sons usually speed quickly through the bloodstream and damage a vital organ, so that by first examining the organs, a toxicologist gets a fair idea if poison was the cause of death. Next, taking a sample of blood, he may examine it under his spectroscope, to see if any poison is present in the blood.

The spectroscope was originally used by astronomers. It breaks up the light rays coming from a star into a spectrum or rainbow. Gases around the star cause bands, like dark stripes, to appear at different points on this rainbow. Their position indicates the composition of the gases.

In the same way the spectroscope breaks up the light transmitted through a test tube of blood into a spectrum. If the blood is pure, two brown bands appear between the green and yellow of the spectrum. If there is poison in the blood, the brown bands will not be in this position. Carbon monoxide in

the blood, for example, will cause the brown bands to move to the right, toward the green of the spectrum.

Some poison traces have been found in the stomach, blood, brain, liver, kidneys, bones, lungs, hair, nails, and muscles.

Poison traces can be seen through a microscope when exposed to ultraviolet light. They can be tested biologically by injecting them into mice and then observing the effects. Chemically they can be isolated, purified, and consequently identified.

Fifty years ago the only test for suspected morphine poisoning was to see if the pupils of the eyes have contracted. One murderer who knew this dropped belladonna into his victim's eyes, which then expanded the pupils back to normal size. His ingenuity did not save his life, for he was eventually convicted after a long trial. Today his trial would be shorter, since there are simple tests which will quickly show the presence of both morphine and belladonna.

Poisoners who used arsenic because it has no smell and is almost tasteless have often been caught simply because arsenic also preserves the body from decomposing. Years after death it has been possible to prove that arsenic was the cause. Arsenic has even been detected in the ashes of cremated bodies.

## HAIR AND FIBER

**A** FEW HAIRS from a crime scene that yields no other clues can tell a detective a surprising amount. If all the hairs have living roots or a mixture of dead and living roots, he can deduce that a fight took place and that the hair was pulled out by force. Should all the hairs have dead roots, he can assume that they fell out naturally.

Supposing he discovers that they have been pulled out by force and that they do not come from the victim of the crime? By examining the morphological characteristics (that is, the shape and structure) of the hairs, the detective can know if they are from the head, body, or beard.

Our detective, let us say, now knows that the hairs are from a beard. By further study of the pigmentation, or coloring, he can tell whether they are from an old man.

Now when a suspect is picked up who has a beard, which tallies with the beard hairs found at the scene, he has some explaining to do.

By examining the tip of a head hair, a scientist can say how recently the hair was cut, whether it is dyed or a natural color, and whether it is naturally or artificially waved.

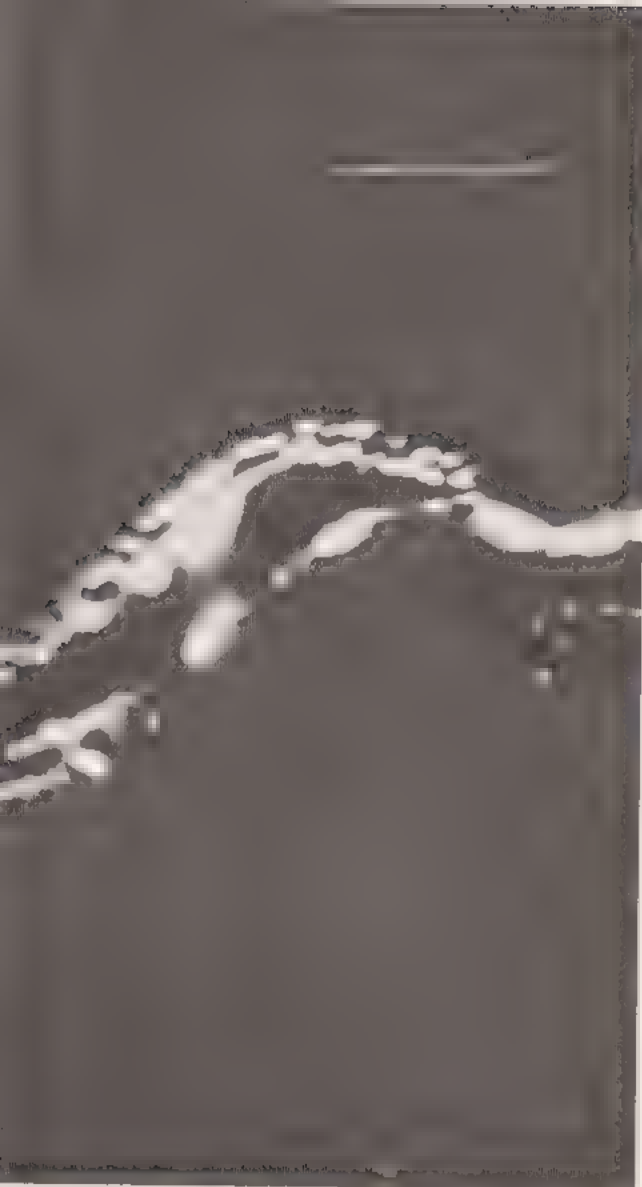


The FBI keeps an ever-increasing file of actual specimens of hairs and fibers for reference purposes.



Many a suspected hit-and-run driver has been cleared when the hair found on the chassis of his automobile was proved to be from an animal. Fur, silk, cotton, linen, glass, asbestos, and many other fibers are instantly recognizable under a microscope.

A hair and fibers expert was asked to examine a rope from which a man had been found hanging. He was presumed to have killed himself. "No," said the expert, "this is murder." In passing over a water pipe the fibers of the rope had been crushed. The direction of this crushing indicated that the body had been hauled up by another person. As it developed, the murderer, hoping to get away with a "perfect" crime, had first knocked his victim unconscious with a rubber hose which left no visible mark. Then he staged the fake suicide.



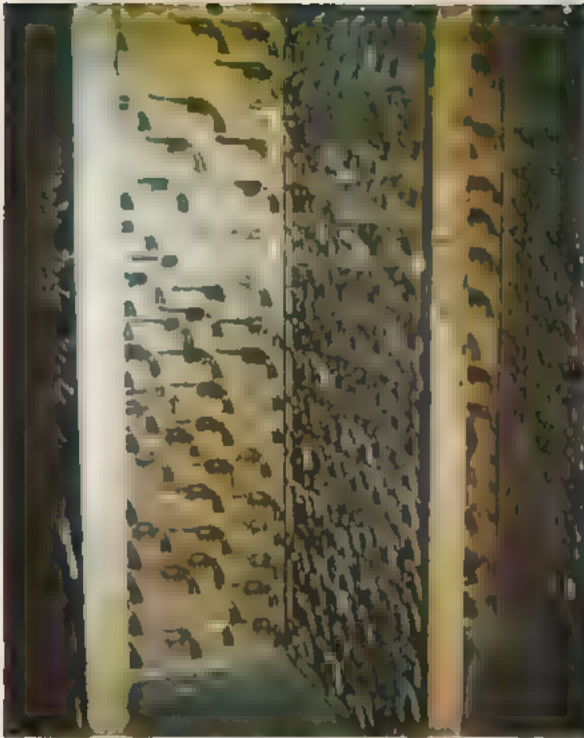
A small piece of yarn from a hit-and-run victim's clothing was removed from the suspect's car. It is placed under the comparison microscope and matched against yarn from the victim's clothing. Here is additional evidence that the suspect's car struck the victim. In the top corners of the picture are the two yarns, shown actual size.

## DUST

**D**UST as a clue in detecting crime, first suggested by Arthur Conan Doyle, was brilliantly handled by Dr. Edmond Locard, the French investigator. He found that a coal miner had coal dust in his ear wax even a year after he had given up his work. Similarly people who worked in flour mills, sawmills, or coffee-roasting plants, or who used threshing machines, showed evidence of their occupation in their ears.

When Dr. Locard was faced with a murder mystery, he was able to put his experience to the test.

A wealthy farmer who cultivated mushrooms was found stabbed to death in a field. Locard vacuumed dust from the farmer and examined it both chem-



8

FBI PISTOL COLLECTION

*Left:* The FBI keeps a reference collection of weapons for study, and in the event that a murder gun is damaged, possibly to prevent identification, there is ready access to spare parts which make possible comparative tests.

*Right:* Fabric is examined under a microscope by a technician in the FBI Laboratory.

ically and under his microscope. Then he announced the result of his investigation. Mud and dust on the farmer's clothes showed he had been dragged across several fields. A rare variety of mushroom spores was in his hair and under his fingernails. Mud on his coat came from his mushroom cellar.

Science helped provide Locard with these answers. Now, with this information he reconstructed the crime, as he imagined it had happened. The farmer, Locard reasoned, had been stabbed while tending his mushroom plants. Then he had been taken to a remote part of the cellar, before his body was finally dragged across several fields and abandoned.

A suspect was brought before Locard, who took a sample of wax from the man's ears. In the wax Locard found salt. The man admitted he had been a sailor. Locard also found dust from various regions of France. The man admitted he had been tramping through the country. Then Locard found a few specks of mushroom spores, the same rare variety that grew in the dead farmer's cellar.

The man confessed to the murder, confirming that Locard, in reconstructing the crime, had described it as surely as if he had seen it happen.





The safe-cracker wore gloves but his shoes collected small bits of insulating material from the safe. These will be used as evidence against him.

The murderer, for instance, had dragged the stabbed farmer to a remote corner of the cellar as Locard had surmised. He did this to hide the body until the daylight had faded and he could move the body under cover of darkness.

Dust found on a man reveals secrets which would never otherwise be discovered. The burglar who breaks a window and leaves no other evidence of his visit carries tiny fragments of glass dust on him. The safe breaker damages the insulating material of the safe wall and carries the dust of this material on his clothes. To cover his tracks a criminal would need to spend much of his time taking showers and sending his clothes to the cleaner.

## *Chemical Tests*

**T**O GATHER DUST from suspects, an ordinary vacuum cleaner with a special filter is used. The dust collected is then sorted, examined under a microscope, and photographed. If necessary it is analyzed chemically, through a spectroscope or viewed under ultraviolet light. By such methods minute particles of dust can be separated and identified as being from a rose petal, coal, or a butterfly's wing, a pollen, blood, poison, or any one of thousands of other substances.

Should the dust particle be so small that it defies any of these methods of analysis, then the very latest electron microscope is used. From a 50,000-volt power source a beam of electrons bombards the dust. On a fluorescent screen the dust is seen magnified 20,000 times. This dust is photographed to a total magnification of 100,000 times natural size. Dust must be very small not to reveal its identity after such treatment.

Is this a bloodstain — or some other, more innocent stain? Here evidence is prepared for a serological examination by the FBI.





In the Document Section of the FBI.

## HANDWRITING AND TYPEWRITING

**A** FORGER who is too careful gives himself away. If he makes an absolutely perfect copy of another man's signature, the expert can expose it as forged. Nobody ever signs his name exactly the same way twice. So that if two signatures appear identical under the microscope, it can be taken as a certainty that one was traced from the other. A mathematician has estimated that the chance of someone writing his own name twice in *exactly* the same way is one in 931 trillion. Even scientists have been unable to find any creature, including man, capable by design or chance of reproducing exactly the same activity in every detail.

After typewriters were invented, forgers and writers of poison-pen and threatening letters used them joyfully, thinking they had hit on a foolproof way of hiding their identities. But the typewriter is able to trap the criminal even more surely than his handwriting. Every typewriter made has its own unique way of writing, and experts can trace a typewritten letter to the one and only machine that produced it.



An examiner in the Document Section of the FBI compares an extortion letter against specimens in the anonymous-letter file.

One man who altered a million-dollar will in his own favor was careful to use the same typewriter that had been used to type the will originally. But since that time a tiny portion of a comma had broken off the type face. The page he re-typed and inserted in the middle of the will was the only page showing faulty commas. This was clearly visible under a microscope, and it was possible to prove that the will was not genuine.

Ultraviolet light will show sometimes whether letters have been erased and others inserted. The ink of a typewriter ribbon can be chemically tested to see if the same ribbon typed the same document.

If a forged page is inserted in a will, not only does the writing often show it up, but the paper can be compared with the others for similar weight, thickness, and watermark.

No piece of paper can be inserted into a typewriter a second time in exactly the same position as it was the first time, so that an investigator can say whether the paper has been inserted for alterations.

Forgers have sworn that a will written in their favor was genuine, while an expert can testify that the document had been typed on a typewriter not even manufactured at the time the will was signed and dated. The only possible conclusions were either that the will was a forgery or that the maker had climbed out of his grave to sign it!

An example of secret writing revealed by the use of ultraviolet light in the Document Section of the FBI.

Dear Friend

This is a very nice  
country. The people are

and apparently happy.

Weather has been

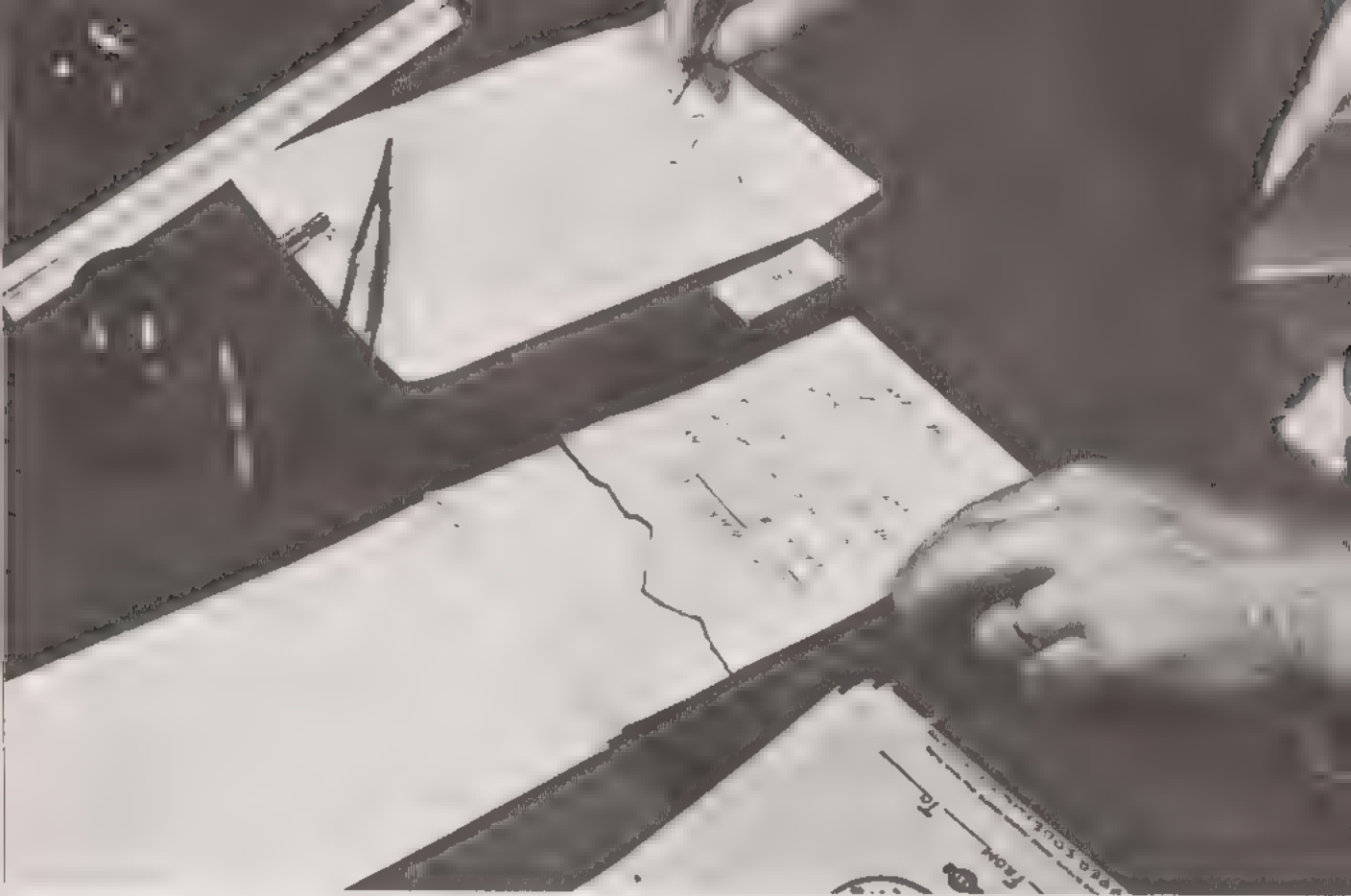
a little rain now

Wish you were here

Yours



Comparison of typewritten specimens in the Document Section of the FBI Laboratory determines the source of an extortion note.



The extortion note had been torn from a notebook; the suspect owned a notebook with a torn page. Here the two parts are pieced together.

## METALS

**A**HIT-AND-RUN DRIVER often leaves behind not only his dead or injured victim but also traces that will finally link the crime to him. It may be only a fragment of metal from the radiator grill, but this is sometimes enough for a metallurgical examiner to determine the make and model of the automobile involved. Analysis of the paint will further narrow down the search to one car and one criminal.

Thieves may think they have completely obliterated the identification of a stolen typewriter or car by filing down the serial numbers. But the serial number has been impressed on the metal deeper than the eye can see and a chemical reagent or heating will bring the impressions into view again.

There is practically no limit to the rule that everything leaves a trace which can be identified by the laboratory analyst. Tools used by burglars to break into a store or house are no exception. They leave marks on the door or window, and similar marks are on the tools which link them without any question to the crime.



Pieces of wood are examined for toolmarks at the FBI.



## INTERROGATION

**A**FTER a traffic accident the driver of a vehicle may not say a word, but his breath may give him away as guilty of dangerous driving. He is requested to breath into an "intoximeter." This sample of his breath is analyzed by a chemist who can estimate how much alcohol was in his blood at the time of the accident.

Investigators from the beginning of crime detection have had two things to help them reach the truth about a crime. One is any object linked with the crime, found at the crime scene, or removed from the scene but later recovered. The other is the statements of witnesses or those involved in the crime.

The lie detector (polygraph) is the first scientific instrument to probe comprehensively the inner working of the human body and changes due specifically to mental stimulation. That it will be improved as additional means of measurement, and additional information of human characteristics, are acquired is unquestionable.

When all else fails, when direct or circumstantial evidence is lacking, yet suspects exist, the polygraph can sometimes get at the truth or at least aid in diverting unfounded suspicion.

In this country no man can be forced to take a lie-detector test. Occasionally today a convicted man has protested his innocence and has asked to be tested by a lie detector. The results have shown further investigation was necessary and ultimately the convicted man has won his freedom.

When most people become afraid, glands in their bodies secrete a hormone called adrenalin to give them more energy, and rush extra blood to the brain, heart, and lungs. This is nature's way of giving the individual sudden strength and energy to protect him from danger. The result is that the heart beats change tempo, breathing is deeper, small arteries contract, and up goes the blood pressure. As well as these changes, fear causes an increase in perspiration.

A frightened man may appear calm on the surface. He may be smiling, his hands may be perfectly relaxed, but changes are taking place inside his body over which he has no control. He may not even be aware they are taking place.

A Canadian Mountie checks a gold prospector's permit.





FBI special agents check in with headquarters on their two-way radio while in the field.

But science can record and measure these changes. The lie detector records on a moving strip of paper in the form of wavy lines what is happening inside the body. The interrogator asks questions which can be answered "yes" or "no." Any sudden change in the pattern of wavy lines indicates that the heart beats, breathing, blood pressure, and rate of perspiration have changed. Why? It is up to the interrogator to find out.

Critics of the lie detector claim that even innocent people would be afraid when answering questions that might incriminate them, and so through nervousness seem to be guilty.

A trained interrogator, however, can easily tell the difference between the naturally nervous and the guilty. He does it by making a "test run" to see how the person responds to innocent questions like "Have you eaten today?" Then he may ask if he is guilty of a crime which he could not possibly have committed. The interrogator then uses the lines made as a result of these questions as a standard to judge later questions by.

Not all states or countries admit the results of lie-detector tests as evidence in courts, though in the hands of an expert they have proved extremely accurate. But the lie-detector interrogation procedure now used obviously depends upon the skill of the operator in selecting questions to ask and interpreting the recorded responses of body reactions. In time, it may be possible to eliminate this risk and make the lie detector virtually foolproof.

## TRUTH DRUGS

**T**RUTH DRUGS have not proved reliable. Scopolamine was first tried by a Texas doctor in 1922, but although suspects under the influence of the drug gave a lot of information it was a bewildering mixture of truth and fantasy, as though they were talking in their sleep. One even accused the detective questioning him of being his partner in crime.

Gas, ether, chloroform, and sodium amytal have all been tried as truth drugs, but proved both unreliable and dangerous.

New drugs which affect behavior, tranquilizers and the like, are likely to prove useful in affecting the impulse to commit crimes, perhaps even curtail or alleviate the most damaging types.

Two G-men handcuff a fugitive from justice.





9. SAWED-OFF SHOTGUN

This "blaster," a sawed-off shotgun, was an actual murder weapon. Now it is kept in the gun collection of the Firearms Unit of the FBI for reference purposes.

## THE FUTURE

**T**HE MOST AMAZING and frightening discovery that a light electric stimulation of the brain can make a man reveal all his secrets promises a world too close for comfort to Aldous Huxley's "Brave New World." One can only hope that no such methods will ever be forcibly used in interrogating suspected criminals. Those concerned with the freedom and dignity of man will fight off such a day for as long as possible.

A Russian researcher has reported that new and more reliable methods of identifying hair have been developed. One method is through light refraction. A difference of 0.0045 in the value of light refraction means that the hairs could not belong to the same person—thus possibly ruling out one suspect. Sturdiness and elasticity of hair is another way of identifying it. A difference of forty grams in the stress needed to break two hairs would mean they came from different persons.

The FBI has been shaking hair up at high speeds from 400,000 to 1,000,000 cycles a second. At those speeds substances in the hair which are similar to those in the blood are put into solution. Chemical tests then identify the substances. Hair, it is predicted, will be classified into groups in the same way as blood.

But all the marvelous instruments of science would be useless without skilled and dedicated men to operate and interpret them. Crime shows no signs of decreasing, and some criminals will doubtless use the latest scientific devices for their own purposes. The need for scientific crime detectives is assured for a long time to come.



## ABOUT THE AUTHOR

DENIS BRIAN has been a correspondent for English and Irish newspapers. He has specialized in crime reporting and has made a special study of crime detection with assistance from FBI special agents, Scotland Yard detectives, questioned-document examiners, and lie-detection experts.

We are indebted to the Federal Bureau of Investigation for all the black and white photographs which appear in this booklet except for the following:

Pages 8, 9, 16

The Bettmann Archive

Pages 14, 17, 59 and the back page  
of the Fingerprint File

Photo Researchers, Inc.

*Color Plates*

Photo Researchers, Inc.

The cover was designed and painted by GIL EVANS; the photograph was provided by Photo Researchers, Inc.

